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Attorneys for Plaintiff
DALI WIRELESS, INC.

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

DALI WIRELESS, INC., Plaintiff, v. CORNING OPTICAL COMMUNICATIONS LLC, Defendant.	Case No. 3:20-cv-06469-EMC **PLAINTIFF DALI WIRELESS, INC.'S SECOND AMENDED COMPLAINT FOR PATENT INFRINGEMENT** The Hon. Edward M. Chen

Plaintiff Dali Wireless Corporation ("Dali") files this Complaint against Defendant Corning Optical Communications LLC ("Corning").

NATURE OF THE CASE

1. This is a case of infringement of three patents: (1) U.S. Patent No. 10,433,261 (the "'261 Patent"), (2) U.S. Patent No. 9,197,358 (the "'358 Patent"), and (3) U.S. Patent No. 10,506,454 (the "'454 Patent"), collectively referred to as "the Patents-in-Suit."

2. Defendant Corning has been making, selling, using and offering for sale, the SpiderCloud Enterprise Radio Access Network ("E-RAN") System that infringes the Patents-in-Suit in violation of 35 U.S.C. § 271. Dali seeks injunctive relief and appropriate damages to compensate for Corning's infringement.

THE PARTIES

3. Dali is a Delaware corporation having its principal place of business in Menlo Park, California.

4. Founded in 2006, Dali began as a designer and manufacturer of power amplifiers used in radio frequency ("RF") communications. Dali is known within the industry as an innovator in providing end-to-end, software defined digital radio distribution solutions that can be implemented in DAS used for cellular, public safety, and other RF communications. Dali is a world-wide innovator in digital radio distribution systems and digital predistortion technology that revolutionized in-building and outdoor wireless coverage and capacity. Dali's groundbreaking products have been consistently recognized by industry publications. For example, Dali has been recognized as a "Hot Tech Innovator" by ABI Research and was ranked No. 1 in innovation in the latest ABI Research report, "In-Building Wireless, DAS Vendor Competitive Assessment." Dali's systems improve upon traditional DAS by allowing the dynamic allocation of wireless coverage and capacity.

5. Corning Optical Communications LLC is a North Carolina Limited Liability Company. On information and belief, Corning has its principal place of business at 4200 Corning Place, Charlotte, NC 28216.

6. In 2017, Corning acquired SpiderCloud Wireless, a company in Milpitas,

California that developed the SpiderCloud E-RAN system. On information and belief, SpiderCloud wireless was merged into Corning Optical Communications LLC.

JURISDICTION AND VENUE

7. This is an action for patent infringement arising under the Patent Laws of the United States, Title 35 of the United States Code.

8. This Court has original subject matter jurisdiction under 28 U.S.C. §§ 1331 and 1338(a).

9. This Court has personal jurisdiction over Corning because Corning is a company organized under the laws of the State of North Carolina and has a place of business and regularly transacts business in this District.

10. Corning has committed and continues to commit, acts of infringement of Dali's Patents-in-Suit in violation of the United States Patent Laws, and has made, used, sold, offered for sale, marketed and/or imported infringing products into this District. Corning's infringement has caused substantial injury to Dali, including within this District.

11. Venue is proper in this District pursuant to 28 U.S.C. §§ 1400 and 1391 because Corning is a North Carolina company and therefore is deemed to reside in this judicial district.

THE PATENTS-IN-SUIT

12. The '261 Patent is titled "Self-optimizing Distributed Antenna System Using Soft Frequency Reuse" and was issued by the United States Patent Office to Seyed Amin Hejazi and Shawn Stapleton on October 1, 2019. A true and correct copy of the '261 patent is attached as Exhibit A.

13. Dali is the owner of all right, title and interest in and to the '261 Patent with the full and exclusive right to bring suit to enforce the '261 Patent.

14. The '261 Patent is valid and enforceable under the United States Patent Laws.

15. The '358 Patent is titled "Method and System for Soft Frequency Reuse in a Distributed Antenna System" and was issued by the United States Patent Office to Seyed Amin Hejazi and Shawn Stapleton on November 24, 2015. A true and correct copy of the '358 Patent is attached as Exhibit B.

16. Dali is the owner of all right, title and interest in and to the ’358 Patent with the full and exclusive right to bring suit to enforce the ’358 Patent.

17. The ’358 Patent is valid and enforceable under the United States Patent Laws.

18. The ’454 Patent is titled “Optimization of Traffic Load in a Distributed Antenna System” and was issued by the United States Patent Office to Shawn Stapleton and Seyed Amin Hejazi on December 10, 2019. A true and correct copy of the ’454 Patent is attached as Exhibit C.

19. Dali is the owner of all right, title and interest in and to the ’454 Patent with the full and exclusive right to bring suit to enforce the ’454 Patent.

20. The ’454 Patent is valid and enforceable under the United States Patent Laws.

FIRST CAUSE OF ACTION

(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 of ’261 PATENT)

21. Dali re-alleges and incorporates by reference all of the foregoing paragraphs.

22. On information and belief, Corning has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 1, of the ’261 Patent in violation of 35 U.S.C. §§ 271 et seq., directly and/or indirectly, by making, using, importing, selling, and/or offering for sale certain equipment and systems relating to E-RAN small cell systems, such as Corning’s currently advertised SpiderCloud Services and Radio nodes. *See* https://www.corning.com/in-building-networks/worldwide/en/home/applications/cellular-solutions/small-cell.html (*last visited on* April 23, 2020).

23. On information and belief, the SpiderCloud Services and Radio nodes were first developed, manufactured and sold by SpiderCloud Wireless. Corning acquired SpiderCloud Wireless in July 2017. *See, e.g.,* https://www.corning.com/worldwide/en/about-us/news-events/news-releases/2017/07/corning-acquires-spidercloud-wireless.html (*last visited on* April 23, 2020).

24. On information and belief, Corning has been and currently is infringing the ’261 patent by the manufacture, use, sale, offer to sell and/or importation of the SpiderCloud Services

and Radio nodes under 35 U.S.C. § 271.

25. Claim 1 of the ’261 patent recites the following:

> [Preamble] 1. A method of determining a transmission power of a digital remote unit (DRU) in a distributed antenna system (DAS), the method comprising:
>
> a) setting a transmission power level for the DRU;
>
> b) determining a key performance indicator related to a number of satisfied users at the transmission power;
>
> c) iteratively adjusting a transmission power level for the DRU to increase the key performance indicator related to the number of satisfied users; and
>
> d) setting the transmission power level for the DRU at an iterated power level.

26. On information and belief, and based on publicly available information, Corning’s SpiderCloud system satisfies each and every limitation of at least claim 1 of the ’261 Patent.

27. To the extent the preamble of claim 1 is interpreted to be limiting, Corning’s SpiderCloud system provides a method for determining a transmission power of a digital remote unit in a DAS. For example, Corning’s SpiderCloud brochure titled, “E-RAN Introduction” describes how SpiderCloud is used to distribute UMTS, LTE and LTE-LAA wireless communications:

E-RAN Platform

An E-RAN system is made up of one rack-unit-sized services node that manages multiple single-carrier or dual-carrier radio nodes operating in 3G, LTE, and unlicensed spectrum.

Services Node

The services node lies at the heart of the SpiderCloud® E-RAN solution. It ensures that the E-RAN system is easy to deploy and manage and that it delivers the performance mobile operators expect. The services node is access technology agnostic, supporting UMTS, LTE, and LTE-LAA. It orchestrates the self-organizing network (SON) process, controls the operation of different radio nodes during neighbor discovery, gathers information from different radio nodes, and creates optimized neighbor lists based on information received from the neighbor scans.

SON capabilities include:

- Discovering the macro cells in the area as well as internal small cell and collocated Wi-Fi topologies.
- Assigning UMTS primary scrambling codes, LTE physical cell identifier, and LAA unlicensed channels.
- Setting maximum transmit power levels based on transmit power detected from adjacent radio nodes and surrounding macro signals.
- Automatically configuring cell neighbor lists to make the system operational.

Radio Nodes

Like Wi-Fi access points, radio nodes are small with low profiles. An E-RAN platform offers a wide range of radio nodes for many different applications and mobile operator configurations. All models are powered by PoE+ (802.11at) Ethernet switch ports.

Installation is quick and easy using commonly available PoE+.

1. Pull a structured cable (CAT 5e or greater).
2. Attach the radio to wall or ceiling.
3. Connect Ethernet patch cords at both ends.

https://www.corning.com/catalog/coc/documents/brochures/CMA-722-AEN.pdf (*last visited* April 23, 2020). Additionally, SpiderCloud's SON feature determines the transmit power levels for the remote radio units.

SON Architecture and External Interfaces

The E-RAN's SON capabilities include discovering the macro cells in the area, discovering the internal small cell topology, assigning UMTS primary scrambling codes and LTE physical cell identifier, setting maximum transmit power levels, and automatically configuring cell neighbor lists to make the system operational.

https://www.corning.com/in-building-networks/worldwide/en/home/applications/cellular-solutions/small-cell/technology/son-auto-configuration.html (*last visited* April 20, 2020).

28. The Corning SpiderCloud system also meets all the requirements of limitation "a" of claim 1. Limitation "a" requires "setting a transmission power level for a DRU." As described in the Corning product literature for SpiderCloud's SON feature, the Services node "periodically adjusts the transmit power levels in order to achieve uniform coverage across the small cell deployment."

> **Periodic Optimization and Self-Maintenance**
>
> While the system is in operational mode, a power optimization feature is used to periodically adjust the transmit power levels in order to achieve uniform coverage across the small cell deployment. The algorithm takes into account several factors:
>
> - The interference level from macro networks as measured by the radio nodes
> - The relative signal strength at which each radio node measures neighboring radio nodes
> - • Periodic signal quality measurements made by user devices across the network and reported back to the services node
>
> The service node uses measurements collected over time to fine-tune the network. For example it might reduce the power level of a congested cell to decrease the number of users on that cell, while powering up lightly loaded cells. The system can also be configured to periodically monitor for changes in topology (added or deleted external and internal cells) and changes in the physical RF environment of the deployment area. For example, the system can be configured to go into scan mode during weekends, when no traffic is expected on the network.

Id. This requires setting the transmit power level as required by limitation "a" of claim 1.

29. Corning's SpiderCloud system also provides the requirements of limitation "b". Limitation "b" requires "determining a key performance indicator related to a number of satisfied users at the transmission power level." The '261 Patent describes "satisfied users" as "the users that can achieve a targeted service bitrate . . . ." As shown in the above citation to Corning's product literature regarding the SON feature, "a power optimization feature is used to periodically adjust the transmit power level to in order to achieve uniform coverage . . . The algorithm takes into account the following factors . . . periodic signal quality measurements made by user devices . . . ." *Id.* Achieving uniform coverage requires ensuring that users are satisfied, *i.e.* that users in a cell can achieve a targeted service bitrate. Additionally, the SpiderCloud documentation cited above states that the system uses "periodic signal quality measurements made by user devices," *i.e.* key performance indicators or their equivalents. Therefore, Corning's SpiderCloud system practices limitation "b" of claim 1 of the '261 Patent.

30. The Corning SpiderCloud system also meets all the requirements of limitation "c". Limitation "c" requires, "iteratively adjusting a transmission power level for the DRU to increase the key performance indicator related to the number of satisfied users". As discussed above in connection with paragraphs 28-29, the SpiderCloud Services node collects signal quality measurements from user devices ***periodically*** and uses that information to fine-tune the

network. One example provided on the SpiderCloud SON website states that "a power optimization feature is used to periodically adjust the transmit power levels in order to achieve uniform coverage across the small cell deployment." *Id.* The multiple references to "periodically" indicate that the power adjustments are iterative in nature. As a result, SpiderCloud practices limitation "c" of claim 1 of the '261 Patent.

31. SpiderCloud also practices limitation "d" of the claim 1. Limitation "d" requires "setting the transmission power level for the DRU at an iterated power level." As discussed above in connection with paragraph 33, the SpiderCloud system ***periodically adjusts*** the transmit power of the radio nodes based on measurements from user devices. Therefore, the transmission power is "set" at the iterated power level. SpiderCloud, therefore, practices limitation "d" of claim 1 of the '261 Patent.

32. Accordingly, on information and belief, Corning's SpiderCloud system meets all the limitations of, and therefore infringes, at least claim 1 of the '261 Patent.

33. As a result of Corning's infringement of the '261 Patent, Dali has suffered and continues to suffer substantial injury and is entitled to recover all damages caused by Corning's infringement to the fullest extent permitted by the Patent Act, together with prejudgment interests and costs for Corning's wrongful conduct.

34. Dali has no adequate remedy at law to prevent future infringement of the '261 Patent. Dali suffers and continues to suffer irreparable harm as a result of Corning's patent infringement and is, therefore, entitled to injunctive relief to enjoin Corning's wrongful conduct.

35. Corning's infringement is particularly brazen, and therefore willful, because as explained below, Corning extensively examined Dali's patent portfolio and proprietary technology – through the guise of a strategic partnership and later potential acquisition – yet did nothing to subsequently ensure its products avoided infringement. Additionally, Corning had specific knowledge of the three patents-in-suit prior to those patents inclusion in the First Amended Complaint. In this District a claim of willful infringement claims requires "knowledge of the . . . [p]atents" and "'egregious' conduct" in order to survive a motion to dismiss." *See, e.g., Fortinet, Inc. v. Forescout Technologies, Inc.*, 2020 U.S. Dist. LEXIS

204580, *42-45 (N.D. Cal. Nov. 2, 2020); Google LLC v. Princeps Interface Techs., 2020 U.S. Dist. LEXIS 52753, *5-10 (N.D. Cal. Mar. 26, 2020); Software Research, Inc. v. Dynatrace LLC, 316 F. Supp. 3d 1112 (N.D. Cal. 2018).

Corning's Notice of the Patents-In-Suit

36. Corning had notice of the patents-in-suit prior to the filing of the an infringement allegation containing the patents-in-suit in two ways. First, it had actual notice of the patents-in-suit.

37. On October 14, 1016, Corning's in-house counsel learned of the '358 Patent.

38. On April 8, 2020, Corning's in-house counsel learned of the '261 Patent.

39. On April 15, 2020, Corning's in-house counsel learned of the '454 Patent.

40. Second, Corning had knowledge of the patents-in-suit through its practice of monitoring Dali's patent portfolio. Despite monitoring Dali's patents and having actual knowledge of published applications corresponding to the patents-in-suit, Corning did nothing to avoid infringing the patents-in-suit. "Post-*Halo*, courts have recognized that allegations of willful blindness can satisfy the knowledge requirement for willful infringement." *Id.* at *25-26; *see also Glob.-Tech Appliances, Inc. v. SEB S.A.*, 563 U.S. 754, 774, 131 S. Ct. 2060, 2073 (2011).

41. Corning's has an extensive history of monitoring Dali's patents and published applications and was at least willfully blind as to whether it infringed the patents-in-suit.

42. In late 2010, representatives of Verizon introduced Corning executives to Dali, as Corning was having problems sourcing power amplifiers, and Verizon knew that Dali had a potential solution.

43. In March of 2011 Corning entered an NDA to discuss purchasing radio distribution system components from Dali.

44. In October 2011, Corning executives visited Dali's research and development headquarters in Vancouver, Canada and later discussed a framework for cooperating on a project. Corning expressed interest in making a strategic investment in Dali.

45. In May 2012, Corning and Dali signed a letter of intent for Dali to develop,

and Corning to purchase, portions of a radio distribution system, namely DT-650 digital transport equipment, beginning weekly calls between Dali and Corning.

46. From May through July of 2012, Corning performed extensive due diligence on Dali's portfolio.

47. In September 2012, after concluding its diligence on Dali, Corning entered into an OEM-IN Hardware (with Software) License and Purchase Agreement memorializing the deal.

48. In December 2012, Corning informed Dali that its DT-650 design had been approved by AT&T.

49. In April 2013, Dali and Corning discussed a broader cooperation between the two companies to include Dali's integrated digital radio distribution platform.

50. In May 2013, Dali and Corning met in Las Vegas for a demonstration of Dali's t-Series integrated digital radio distribution platform including its dynamic capacity allocation load-balancing technique.

51. In October-November 2013, Corning informed Dali that it was reevaluating its business case relating to the DT-650, but Corning suggested that other projects and opportunities for collaboration with Dali would arise.

52. In March 2014, Corning reached out to Dali to discuss completing the DT-650 project and beginning a new project involving reconfiguring Corning's product with a base station interface to comply with the Common Public Radio Interface ("CPRI") standard.

53. On June 3, 2014, Corning's corporate development team met with Dali at its Palo Alto offices to discuss Corning acquiring Dali. Dali presented an overview of the company's strategy, product roadmap and IP positioning.

54. On or about July 3, 2014, Corning conducted additional diligence at Dali's Vancouver R&D facility. Corning conducted or had conducted on its behalf offsite IP diligence including an analysis of Dali's patent portfolio.

55. Corning offered Dali up to $100M for its business and IP holdings.

56. Dali subsequently won a contract to install a radio distribution system at the

Dallas-Ft. Worth Airport.

57. On information and belief in 2015, Corning had discussions with Commscope regarding radio distribution systems, distributed antenna systems, small cells, or radio access networks.

58. On information and belief, the discussion with Commscope in 2015 related in part to Dali's products or patents.

59. Corning was informed that at least one Dali product would become the subject of an lawsuit accusing Dali of infringement.

60. In August 2015, Commscope acquired TE Connectivity's Telecom, Enterprise and Wireless businesses, including its patents.

61. In January 2016, Dali's products were approved for use by AT&T.

62. In February 2016, Commscope filed a patent infringement suit against Dali, asserting the patents that it acquired from TE Connectivity in August 2015. *See* https://www.commscope.com/press-releases/2015/commscope-completes-transformational-acquisition-of-te-connectivitys-telecom-enterprise-and-wireless-businesses/.

63. At some point in the 2015 to early 2016 timeframe, Corning lost interest in acquiring Dali.

64. At least as early as August 8, 2016, Corning learned of U.S. Patent Application No. 2014/0162644 which became the '454 Patent.

65. On information and belief, Corning discovered the '644 application through is practice of monitoring Dali's patent portfolio and filings.

66. In 2017, Corning acquired SpiderCloud, obtaining the products accused of infringement in this lawsuit.

67. On information and belief, Corning did nothing to ensure that the products acquired as part of the SpiderCloud acquisition did not infring Dali's patents.

68. On information and belief, Corning continued to monitor Dali's patent portfolio.

69. In 2019, the parties against discussed licening Dali's portfolio at the World

Mobile Conference in Spain.

70. As a result of the activities described in paragraphs 41-67 above, Corning had extensive knowledge of Dali's patents, yet did not do anything to ensure it was not infringing Dali's patents until April 2020.

<u>Corning's Conduct is Egregious</u>

71. Corning's conduct is egregious because it is both deliberate, and it harmed the market for Dali's products and Dali's reputation as an technology leader in the industry. According to *Halo* a claim for willfulness requires a pleading of some form of egregious conduct that "has been variously described . . . as . . . deliberate" among other things. *Halo Elecs., Inc. v. Pulse Elecs., Inc.*, 136 S. Ct. 1923, 1937 (2016).

72. Corning continues to develop and market products that infringe Dali's patents and harming Dali's reputation as a technological leader in the digital DAS market. For example, Corning recently sought FCC approval for its yet-to-be released "Building Wireless System" products. https://fccid.io/document.php?id=4615900. Included in the FCC filings is a publicly accessible user manual for its next generation Low Power Radio ("LPR"). The LPR User Manual indicates that the BWS system implements many features that Dali has

Building Wireless System (BWS) v1.0

Low Power Radio (LPR) User Manual

CORNING

patented. For example, Corning's LPR User Manual explains that BWS is a digital DAS, something that Dali pioneered and extensively patented:

> Corning's BWS™ platform 1.0 is the first fully-digital, end-to-end in-building cellular solution, for medium size venues. It provides coverage of 200,000 – 500,000 square feet, of mobile communication voice and data traffic, covering a wide range of frequencies. Being a pure digital system dramatically reduces system costs, and the system foot print.

Additionally, Corning's LPR User Manual refers to features that are the subject of multiple Dali patents such as load management, dynamic routing, and capacity steering, among many others:

> ➢ **Flexible and economic traffic management; Optimized network utilization:**
>
> A unique combination of smart traffic management techniques, allowing load (and thus cost) reduction based. These optimizations are achieved via automated management considerations and path selection techniques. e.g.: **Dynamic routing** (from each vBBU port to each remote port and vice versa); **Advanced clusterization logic** (up to 24 clusters; allows downlink forking and then uplink summing, to reduce CPRI throughput); **capacity steering techniques**, and more.

Corning's LPR User Manual also appears to show that the BWS system implements Dali's soft frequency reuse patents. The Corning FCC filing demonstrates that unless Corning is enjoined from infringing Dali's patents, Corning will continue developing products that incorporate Dali's extensively patented technologies. Dali will be irreparably harmed as Dali should not be required to compete in the marketplace against its own technology due to Corning's infringement, acts for which there is no adequate remedy at law.

73. Corning additionally continues to sell the accused SpiderCloud products that infringe Dali's patents without authorization.

74. Corning's ONE system also infringed Dali's patents, as demonstrated by *Dali Wireless, Inc. v. Corning Inc. et al.* Case No. 6:20-cv-01108 (WDTX, 2020).

75. As demonstrated by the examples in paragraphs 71-74, Corning's conduct in deliberate and therefore egregious.

SECOND CAUSE OF ACTION

(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 of '358 PATENT)

76. Dali re-alleges and incorporates by reference all of the foregoing paragraphs.

77. On information and belief, Corning has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 7, of the '358 Patent in violation of 35 U.S.C. §§ 271 et seq., directly and/or indirectly, by making, using, importing, selling, and/or offering for sale certain equipment and systems relating to E-RAN small cell systems, such as SpiderCloud's currently advertised Services and Radio nodes. *See* https://www.corning.com/in-building-networks/worldwide/en/home/applications/cellular-

solutions/small-cell.html (*last visited on* April 23, 2020).

78. On information and belief, Corning has been and currently is infringing the '358 Patent by the manufacture, use, sale, offer to sell and/or importation of the SpiderCloud Services and Radio nodes under 35 U.S.C. § 271.

79. Claim 7 of the '358 Patent recites the following:

> [Preamble] A method of distributing communications frequencies, the method providing:
>
> [A] providing a set of communications units;
>
> [B] transmitting and receiving, from a first communications unit of the set of communications units:
>
> [C] a first set of frequencies characterized by a first frequency band and a first geographic footprint; and
>
> [D] a second set of frequencies characterized by a second frequency band different from the first frequency band and a second geographic footprint larger than and at least partially surrounding the first geographic footprint; and
>
> [E] transmitting, and receiving, from a second communications unit of the set of communications units:
>
> [F] a third set of frequencies including one or more frequencies in the first frequency band and a third geographical footprint; and
>
> [G] a fourth set of frequencies including one or more frequencies in a third frequency band and a fourth geographical footprint larger than and at least partially surrounding the third geographical footprint.

80. On information and belief, and based on publicly available information, Corning's SpiderCloud system satisfies each and every limitation of at least claim 7 of the '358 Patent.

81. To the extent the preamble of claim 7 is interpreted to be limiting, Corning's SpiderCloud system provides a method for distributing communications frequencies. For example, Corning's SpiderCloud brochure titled, "E-RAN Introduction" describes how SpiderCloud is used to distribute UMTS, LTE, and LTE-LAA wireless communications, which include various communication frequencies:

E-RAN Platform

An E-RAN system is made up of one rack-unit-sized services node that manages multiple single-carrier or dual-carrier radio nodes operating in 3G, LTE, and unlicensed spectrum.

Services Node

The services node lies at the heart of the SpiderCloud® E-RAN solution. It ensures that the E-RAN system is easy to deploy and manage and that it delivers the performance mobile operators expect. The services node is access technology agnostic, supporting UMTS, LTE, and LTE-LAA. It orchestrates the self-organizing network (SON) process, controls the operation of different radio nodes during neighbor discovery, gathers information from different radio nodes, and creates optimized neighbor lists based on information received from the neighbor scans.

SON capabilities include:

- Discovering the macro cells in the area as well as internal small cell and collocated Wi-Fi topologies.
- Assigning UMTS primary scrambling codes, LTE physical cell identifier, and LAA unlicensed channels.
- Setting maximum transmit power levels based on transmit power detected from adjacent radio nodes and surrounding macro signals.
- Automatically configuring cell neighbor lists to make the system operational.

Radio Nodes

Like Wi-Fi access points, radio nodes are small with low profiles. An E-RAN platform offers a wide range of radio nodes for many different applications and mobile operator configurations. All models are powered by PoE+ (802.11at) Ethernet switch ports.

Installation is quick and easy using commonly available PoE+.

1. Pull a structured cable (CAT 5e or greater).
2. Attach the radio to wall or ceiling.
3. Connect Ethernet patch cords at both ends.

https://www.corning.com/catalog/coc/documents/brochures/CMA-722-AEN.pdf (*last visited* April 23, 2020).

82. Corning's SpiderCloud E-RAN system also provides the requirements of limitation "A." Limitation "A" requires "providing a set of communications units." According to the SpiderCloud product website, multiple radio nodes are connected to the Services Node using standard Ethernet LAN infrastructure. https://www.corning.com/in-building-networks/worldwide/en/home/applications/cellular-solutions/small-cell.html/products (*last visited* April 28, 2020). The "multiple radio nodes" referred to above are the "set of communication units" required by limitation "A." More specifically, the Corning SpiderCloud E-RAN uses several available Corning Radio nodes, each serving as a "communication unit":

Radio Node Family

Capabilities	SCRN-310	SCRN-220	SCRN-320	SCRN-330	SCRN-340
Available models	Band 4 & 13 (model -0413) Band 4 & 2 (model -04L2)	Band 4 (66) or Band 2(25) or Band 13	Band 4 + 5 GHz Band 2 + 5 GHz Band 4(66) + 5 GHz	Band 41 (Sprint) or 48 (CBRS)	Band 2 (25) or 4 (66) & Band 13 or 14
Carrier aggregation (CA)	Yes	No	Licensed and unlicensed up to 60 MHz (3 CC CA)	No	Yes
Peak speed (Mbps)	225 Mbps with CA (0413) 300 Mbps with CA (04L2) 150 Mbps without CA	150	270 Mbps (Chan 32 only) 400 Mbps (3 CCA)	Peak DL rate of 100 Mbps with FC2	225 Mbps with CA 150 Mbps without CA
Number of active users	128/band (256 for dual-band)	128	128 (with LAA)	128	128/band (256 for dual-band)
Number of VoLTE users (subset of number active)	64 with CA 128 (64/band), without CA	64	64 (with LAA)	64	64 with CA 128 (64/band), without CA
Support for CAT-M1	No	Yes	Yes	No	Yes
Transmit power	250 mW	500 mW	500 mW	500 mW	500 mW
Coverage	8,000 – 10,000	10,000 – 13,000	10,000 – 13,000	10,000 – 13,000	10,000 – 13,000
Antennas	Internal External as option	Internal External as option	Internal	Internal External as option	Internal External as option

https://www.corning.com/catalog/coc/documents/brochures/CMA-722-AEN.pdf at 2 (*last visited on* April 23, 2020). Thus, limitation "A" is met by the Corning SpiderCloud system through its "providing a set of communications units."

83. Corning's SpiderCloud E-RAN system provides the requirements of limitations "B" and "C." Limitations "B" and "C" together require "transmitting and receiving, from a first communications unit of the set of communications units[ ] a first set of frequencies characterized by a first frequency band and a first geographic footprint." According to the Corning SpiderCloud Services Node 9000 specification, the SpiderCloud system uses "[c]entrally coordinated dynamic fractional frequency reuse for [inter-cell interference coordination ("ICIC")]. https://www.corning.com/catalog/coc/documents/product-specifications/LAN-2319-AEN.pdf at 3 (*last visited on* April 23, 2020). A centrally coordinated dynamic fractional frequency reuse scheme uses different frequencies for the outer areas of cells to reduce inter-cell interference, while at the same time reusing the frequencies used for inner cell areas.

84. Additionally, and on information and belief, SpiderCloud's dynamic fractional frequency reuse technique is described in further detail in Corning's United States Patent No. 9,510,205 (the "SpiderCloud '205 Patent"), titled "Load-Based Dynamic Fractional Frequency

Reuse in an LTE Network," originally issued to SpiderCloud Wireless, Inc.

85. As explained in the SpiderCloud '205 Patent, each radio node of the SpiderCloud system has a "radio coverage area," *i.e.* a geographic footprint. SpiderCloud '205 Patent at 3:4-6. Each radio node of the SpiderCloud E-Ran system also transmits (*i.e.* a downlink channel) data to user equipment, such as mobile phones, smartphones, tablet computing devices, and the like (collectively "UEs") and receives (*i.e.* an uplink channel) data from UEs within the system. SpiderCloud '205 Patent at 3:19-22, 4:42-45, Fig. 3 (describing downlink channels in which data is "served" to UEs by a first radio node); *see also id.* 4:54-55, Fig. 4 (providing an uplink diagram in which data is transmitted from UEs back to the radio node). More specifically, the SpiderCloud '205 Patent describes how the SpiderCloud E-RAN system provides a radio node that transmits and receives a "first set of frequencies characterized by a first frequency band" over "a first geographic footprint."

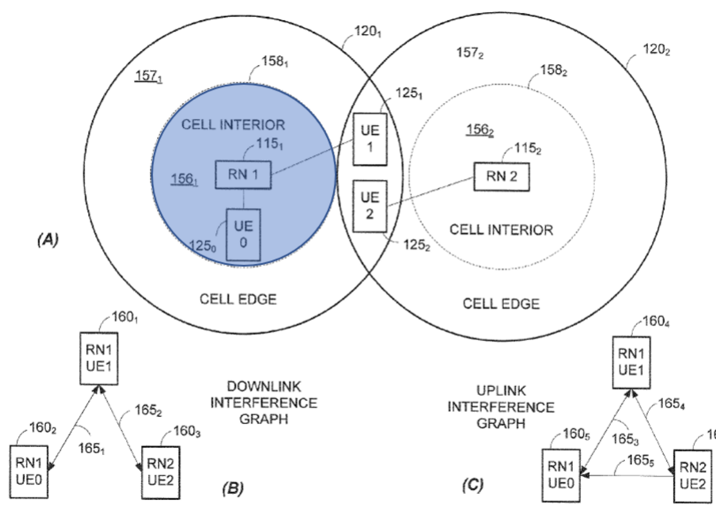

Fig. 5

SpiderCloud '205 Patent at 6:23-29, Fig. 5 (noting that "within each cell, different frequencies (or sets of frequencies) may be allocated as between UEs in the cell edge and those in the cell interior.") (highlighting added). Thus, limitations "B" and "C" are met by the Corning SpiderCloud system through its "transmitting and receiving, from a first communications unit of the set of communications units[ ] a first set of frequencies characterized by a first frequency band and a first geographic footprint."

86. Corning's SpiderCloud E-RAN system provides the requirements of limitation "D." Limitation "D" requires that the first communications unit transmit and receive "a second

set of frequencies characterized by a second frequency band different from the first frequency band and a second geographic footprint larger than and at least partially surrounding the first geographic footprint." As described above, a centrally coordinated dynamic fractional frequency reuse scheme uses different frequencies for the outer areas of cells to reduce inter-cell interference, while at the same time reusing the frequencies used for inner cell areas, which necessarily performs the features of limitation "D." Additionally, SpiderCloud's '205 Patent explains that the SpiderCloud E-RAN system's dynamic fractional frequency reuse method provides that "within each cell, different frequencies (or sets of frequencies) may be allocated as between UEs in the cell edge and those in the cell interior." SpiderCloud '205 Patent at 6:23-29, Fig. 5. Therefore, the first communications unit will use a different frequency to transmit and receive data with UEs at its cell edge, which surrounds the cell interior over a larger geographic

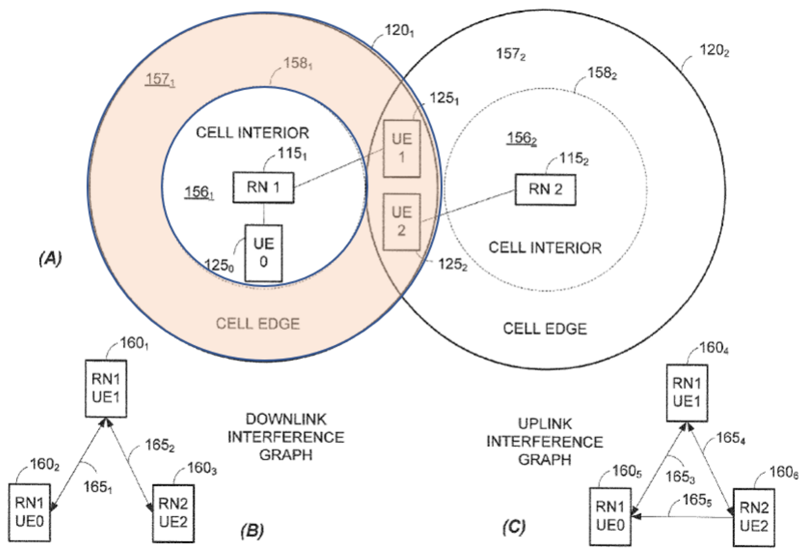

Fig. 5

footprint:

SpiderCloud Patent at 6:23-29, Fig. 5 (highlighting added).

87. Thus, limitation "D" is met by the Corning SpiderCloud system through its providing a first communications unit that transmits and receives "a second set of frequencies characterized by a second frequency band different from the first frequency band" over a "second geographic footprint larger than and at least partially surrounding the first geographic footprint."

88. Corning's SpiderCloud E-RAN system provides the requirements of limitations

"E" and "F." Limitations "E" and "F" require "transmitting, and receiving, from a second communications unit of the set of communications units[ ] a third set of frequencies including one or more frequencies in the first frequency band and a third geographical footprint." As described above, a centrally coordinated dynamic fractional frequency reuse scheme uses different frequencies for the outer areas of cells to reduce inter-cell interference, while at the same time reusing the frequencies used for inner cell areas, which necessarily performs the features of limitations "E" and "F." Additionally, SpiderCloud's '205 Patent explains that in the dynamic fractional frequency reuse method of the SpiderCloud E-RAN system:

> A first frequency may be chosen for a UE within the first cell edge (step 172). A second frequency may then be chosen for a UE within the second cell edge, where the second frequency is different from the first frequency (step 172). Frequencies other than the first (or second) frequencies may then be employed for the first (or second) cell interiors (step 176).

SpiderCloud '205 Patent at 6:34-38.

89. The SpiderCloud system's fractional frequency reuse method therefore provides for radio nodes to transmit and receive data with UEs by "reusing" the same frequencies within the cell interiors of adjacent radio nodes.

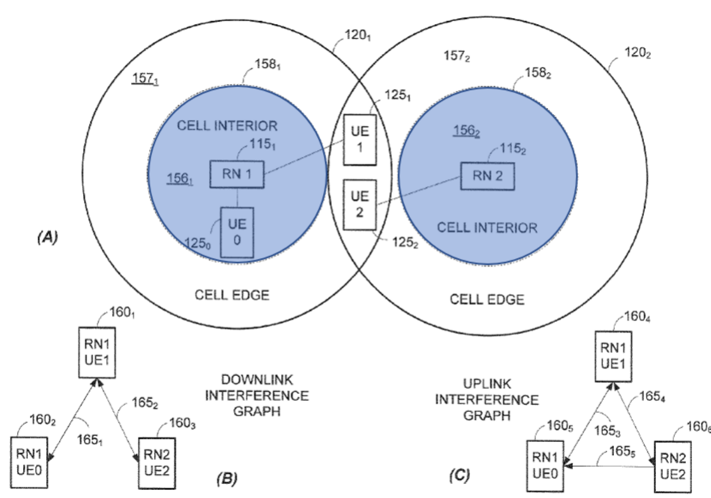

Fig. 5

SpiderCloud '205 Patent at Figure 5 (highlighting added).

90. Thus, limitations "E" and "F" are met by the Corning SpiderCloud system through its "transmitting, and receiving, from a second communications unit of the set of communications units[ ] a third set of frequencies including one or more frequencies in the first

frequency band and a third geographical footprint."

91. Corning's SpiderCloud system provides the requirements of limitation "G." Limitation "G" requires that the second communications unit transmit and receive "a fourth set of frequencies including one or more frequencies in a third frequency band and a fourth geographical footprint larger than and at least partially surrounding the third geographical footprint." As described above, a centrally coordinated dynamic fractional frequency reuse scheme uses different frequencies for the outer areas of cells to reduce inter-cell interference, while at the same time reusing the frequencies used for inner cell areas, which necessarily performs the features of limitation "G." Additionally, SpiderCloud's '205 Patent explains that in SpiderCloud System's dynamic fractional frequency reuse method:

> MAC schedulers at the individual radio nodes are then controlled so that adjacent cell edges use different frequencies, i.e., the method assigns different frequencies to cell-edge UEs (step 164). As an additional step, within each cell, different frequencies (or sets of frequencies) may be allocated as between UEs in the cell edge and those in the cell interior (step 166).

SpiderCloud '205 Patent at 6:23-29, Fig. 5.

92. Therefore, the second communications unit will use a frequency to transmit and receive data with UEs at its cell edge over an area that is larger than and surrounds the cell interior, and which frequency is different from the frequency used on the cell edge of the adjacent cell edge of the first communications unit:

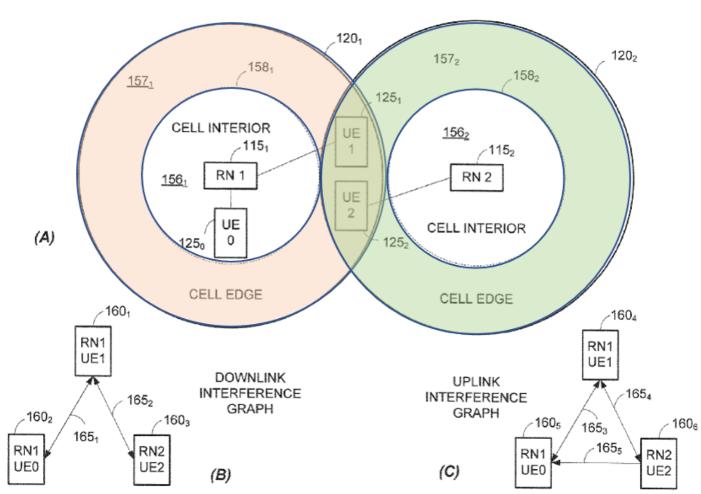

Fig. 5

SpiderCloud Patent at 6:23-29, Fig. 5 (highlighting added).

93. Thus, limitation "G" is met by the Corning SpiderCloud system through its providing a second communications unit that transmits and receives "a fourth set of frequencies including one or more frequencies in a third frequency band" and does so over "a fourth geographical footprint larger than and at least partially surrounding the third geographical footprint."

94. Accordingly, on information and belief, Corning's SpiderCloud system meets all the limitations of, and therefore infringes, at least claim 7 of the '358 Patent.

95. As a result of Corning's infringement of the '358 Patent, Dali has suffered and continues to suffer substantial injury and is entitled to recover all damages caused by Corning's infringement to the fullest extent permitted by the Patent Act, together with prejudgment interests and costs for Corning's wrongful conduct.

96. As described in paragraphs 35-75 above, Corning's infringement is willful.

97. Dali has no adequate remedy at law to prevent future infringement of the '358 Patent. As described in paragraphs 71-74 above, Dali suffers and continues to suffer irreparable harm as a result of Corning's patent infringement and is, therefore, entitled to injunctive relief to enjoin Corning's wrongful conduct.

THIRD CAUSE OF ACTION

(PATENT INFRINGEMENT UNDER 35 U.S.C. § 271 of '454 PATENT)

98. Dali re-alleges and incorporates by reference all of the foregoing paragraphs.

99. On information and belief, Corning has infringed and continues to infringe, either literally or under the doctrine of equivalents, one or more claims, including at least claim 1, of the '454 patent in violation of 35 U.S.C. §§ 271 et seq., directly and/or indirectly, by making, using, importing, selling, and/or offering for sale certain equipment and systems relating to E-RAN small cell systems, such as SpiderCloud's currently advertised Services and Radio nodes. *See* https://www.corning.com/in-building-networks/worldwide/en/home/applications/cellular-solutions/small-cell.html (*last visited on* April 23, 2020).

100. On information and belief, Corning has been and currently is infringing the '454 Patent by the manufacture, use, sale, offer to sell and/or importation of the SpiderCloud Services and Radio nodes under 35 U.S.C. § 271.

101. Claim 1 of the '454 Patent recites the following:

> [Preamble] 1. A system for dynamically routing signals in a Distributed Antenna System (DAS) operable to communicate with a plurality of signal sources, the system comprising:
>
> [A] one or more Digital Access Units (DAUs) operable to receive at least one signal from at least one of a first signal source and a second signal source from the plurality of signal sources, each DAU of the one or more DAUs including an input port configured as an uplink/downlink port and an output port configured as an uplink/downlink port;
>
> [B] a plurality of Digital Remote Units (DRUs) coupled to the one or more DAUs and operable to transport signals between the plurality of DRUs and the one or more DAUs;
>
> [C] a plurality of sectors formed from the plurality of DRUs comprising a first sector and a second sector different from the first sector, each sector comprising a subset of the plurality of DRUs; and
>
> [D] a traffic monitoring unit coupled to at least one of the DAUs comprising the input port and output port each configured as an uplink/downlink port, wherein the traffic monitoring unit is configured to:
>
> [E] determine one or more key performance indicators (KPIs) and a quality of service (QoS) of a network traffic for the one or more DAUs, wherein the QoS is a function of the one or more KPIs; and
>
> [F] reconfigure the plurality of sectors based on the one or more KPIs and QoS by allocating at least one DRU from the first sector to the second sector.

102. To the extent the preamble of claim 1 is determined to be limiting, Corning's SpiderCloud system practices the features of the preamble. For example, Corning's SpiderCloud brochure titled, "E-RAN Introduction" describes how SpiderCloud is used to distribute UMTS, LTE, and LTE-LAA wireless communication, including multiple signal sources:

E-RAN Platform

An E-RAN system is made up of one rack-unit-sized services node that manages multiple single-carrier or dual-carrier radio nodes operating in 3G, LTE, and unlicensed spectrum.

Services Node

The services node lies at the heart of the SpiderCloud® E-RAN solution. It ensures that the E-RAN system is easy to deploy and manage and that it delivers the performance mobile operators expect. The services node is access technology agnostic, supporting UMTS, LTE, and LTE-LAA. It orchestrates the self-organizing network (SON) process, controls the operation of different radio nodes during neighbor discovery, gathers information from different radio nodes, and creates optimized neighbor lists based on information received from the neighbor scans.

SON capabilities include:

- Discovering the macro cells in the area as well as internal small cell and collocated Wi-Fi topologies.
- Assigning UMTS primary scrambling codes, LTE physical cell identifier, and LAA unlicensed channels.
- Setting maximum transmit power levels based on transmit power detected from adjacent radio nodes and surrounding macro signals.
- Automatically configuring cell neighbor lists to make the system operational.

Radio Nodes

Like Wi-Fi access points, radio nodes are small with low profiles. An E-RAN platform offers a wide range of radio nodes for many different applications and mobile operator configurations. All models are powered by PoE+ (802.11at) Ethernet switch ports.

Installation is quick and easy using commonly available PoE+.

1. Pull a structured cable (CAT 5e or greater).
2. Attach the radio to wall or ceiling.
3. Connect Ethernet patch cords at both ends.

https://www.corning.com/catalog/coc/documents/brochures/CMA-722-AEN.pdf (*last visited* April 23, 2020).

103. The Corning SpiderCloud system practices all the features of limitation "A" of claim 1 of the '454 Patent. Limitation "A" requires the following: "one or more Digital Access Units (DAUs) operable to receive at least one signal from at least one of a first signal source and a second signal source from the plurality of signal sources, each DAU of the one or more DAUs including an input port configured as an uplink/downlink port and an output port configured as an uplink/downlink port". As described in Corning's datasheet for the "SpiderCloud Services Node 9000 Dual Mode 3G UMTS and 4G LTE Air Interface", SpiderCloud's Services Node provides "Multioperator core network support for UMTS and LTE . . . ." https://www.corning.com/catalog/coc/documents/product-specifications/LAN-2319-AEN.pdf (*last visited on* April 23, 2020). The Services Node is a Digital Access Unit that receives one signal from one operator and a second signal from another operator, *i.e.* "Multioperator core network support . . . ." Additionally, the Services Node has multiple input-output ports:

Interfaces	8 x Gbps Ethernet ports
	2 x Gbps SFP Ethernet ports
	1 x RJ45 console port (RS-232)
	1 x 10/100 management port
	1 x TNC connector for GNSS antenna

Id. Therefore, Corning's SpiderCloud system practices all the features of limitation "A" of claim 1 of the '454 Patent.

104. The Corning SpiderCloud system practices all the features of limitation "B" of claim 1 of the '454 Patent. Limitation "B" requires the following: "a plurality of Digital Remote Units (DRUs) coupled to the one or more DAUs and operable to transport signals between the plurality of DRUs and the one or more DAUs". As described in connection with paragraph 60, the SpiderCloud Services Node is connected to and communicates with a plurality of Radio Nodes, *i.e.* DRUs, via an Ethernet network. Therefore, the Corning SpiderCloud system practices all the features of limitation "B" of the claim 1 of the '454 Patent.

105. The Corning SpiderCloud system practices all the features of limitation "C" of claim 1 of the '454 Patent. Limitation "C" requires the following: "a plurality of sectors formed from the plurality of DRUs comprising a first sector and a second sector different from the first sector, each sector comprising a subset of the plurality of DRUs". According the Corning's SpiderCloud SON description, the Services Node manages various parameters of individual Radio Nodes creating "sectors":

Periodic Optimization and Self-Maintenance

While the system is in operational mode, a power optimization feature is used to periodically adjust the transmit power levels in order to achieve uniform coverage across the small cell deployment. The algorithm takes into account several factors:

- The interference level from macro networks as measured by the radio nodes
- The relative signal strength at which each radio node measures neighboring radio nodes
- Periodic signal quality measurements made by user devices across the network and reported back to the services node

The service node uses measurements collected over time to fine-tune the network. For example, it might reduce the power level of a congested cell to decrease the number of users on that cell, while powering up lightly loaded cells. The system can also be configured to periodically monitor for changes in topology (added or deleted external and internal cells) and changes in the physical RF environment of the deployment area. For example, the system can be configured to go into scan mode during weekends, when no traffic is expected on the network.

https://www.corning.com/in-building-networks/worldwide/en/home/applications/cellular-solutions/small-cell/technology/son-auto-configuration.html (*last visited on* April 23, 2020). For

example, “the services node uses measurements collected over time to fine-tune the network. For example, it might reduce the power level of a congested cell to decrease the number of users on that cell, while powering up lightly loaded cells.” *Id.* In this example, the congested cell is one sector, whereas the lightly loaded cells are another sector. Therefore, Corning’s SpiderCloud system practices all the features of limitation “C” of claim 1 of the ’454 Patent.

106. On information and belief, the Corning SpiderCloud system practices all the features of limitation “D” of claim 1 of the ’454 Patent. Limitation “D” requires the following: “a traffic monitoring unit coupled to at least one of the DAUs comprising the input port and output port each configured as an uplink/downlink port.” As described above in paragraph 105, the SpiderCloud Services Node SON feature modifies the parameters of the Radio Nodes to adjust for congested cells: “it might reduce the power level of a congested cell to decrease the number of users on that cell . . . .” In order to do that, the Services Node must be able to identify levels of congestion in the system, and as such, contains a “traffic monitoring unit” or its equivalent. As such, the Corning SpiderCloud system practices all the features of limitation “D” of claim 1 of the ’454 Patent.

107. On information and belief, the Corning SpiderCloud system practices all the features of limitation “E” of claim 1 of the ’454 Patent. Limitation “E” requires the following: “determine one or more key performance indicators (KPIs) and a quality of service (QoS) of a network traffic for the one or more DAUs, wherein the QoS is a function of the one or more KPIs”. As shown in paragraph 105, SpiderCloud’s SON feature includes making various measurements of the radio environment such as “periodic signal quality measurements made by user devices across the network and reported back to the services node.” These signal quality measurements are examples of key performance indicators or their equivalents in the SpiderCloud system. Also shown in paragraph 105, SpiderCloud’s SON feature contains an algorithm the utilizes these key performance indicators, such as the periodic signal quality measurements, to modify the radio parameters of the Radio Nodes to achieve some level of service for user devices being served by the SpiderCloud system, including to “reduce the power level of a congested cell . . . while powering up lightly loaded cells.” Thus, the SON algorithm is

determining a quality of service which is a function of one or more key performance indicators. As a result, the Corning SpiderCloud system practices all the features of limitation "E" of claim 1 of the '454 Patent.

108. On information and belief, the Corning SpiderCloud system practices all the features of limitation "F" of claim 1 of the '454 Patent. Limitation "F" requires the following: "reconfigure the plurality of sectors based on the one or more KPIs and QoS by allocating at least one DRU from the first sector to the second sector." As shown in paragraph 105, the Services Node's SON feature performs "Periodic Optimization and Self-Maintenance" including "periodic adjust[ment]" based on "measurements collected over time to fine tune the network." Such fine-tuning includes "reduc[ing] the power level of a congested cell . . . while powering up lightly loaded cells." The power level adjustments are an example of how the SON feature reconfigures sectors based on the one or more KPI and QoS. Therefore, Corning's SpiderCloud system practices all the features of limitation "F" or claim 1 of the '454 Patent.

109. Accordingly, on information and belief, Corning's SpiderCloud system meets all the limitations of, and therefore infringes, at least claim 1 of the '454 Patent.

110. As a result of Corning's infringement of the '454 Patent, Dali has suffered and continues to suffer substantial injury and is entitled to recover all damages caused by Corning's infringement to the fullest extent permitted by the Patent Act, together with prejudgment interests and costs for Corning's wrongful conduct.

111. As described in paragraphs 35-75 above, Corning's infringement is willful.

112. Dali has no adequate remedy at law to prevent future infringement of the '454 Patent. As described in paragraphs 71-74 above, Dali suffers and continues to suffer irreparable harm as a result of Corning's patent infringement and is, therefore, entitled to injunctive relief to enjoin Corning's wrongful conduct.

PRAYER FOR RELIEF

WHEREFORE, Dali respectfully requests judgment against Corning as follows:

A. That the Court enter judgment for Dali on all causes of action asserted in this Complaint;

B. That the Court enter an injunction prohibiting Corning and its agents, officers, servants, employees, and all persons in active concert or participation with Corning from making, using, advertising, selling, and offering for sale the infringing SpiderCloud products and from otherwise infringing any of the Patents-in-Suit;

C. That the Court enter judgment in favor of Dali and against Corning for monetary damages to compensate it for Corning's willful infringement of the Patents-in-Suit pursuant to 35 U.S.C. § 284, including increased damages for willful infringement, costs, and pre-judgment and post-judgment interest as allowed by law;

D. That the Court enter judgment in favor of Dali and against Corning for accounting and/or supplemental damages for all damages occurring after any discovery cutoff and through the Court's entry of final judgment;

E. That the Court enter judgment that this case is exceptional under 35 U.S.C. § 285 and enter an award to Dali of its costs and attorneys' fees; and

F. That the Court award Dali all further relief as the Court deems just and proper.

JURY DEMAND

Dali requests that all claims and causes of action raised in this Complaint against Corning be tried to a jury to the fullest extent possible.

DATED: September 20, 2021

Respectfully submitted,

By: */s/ David Schumann*

Attorneys for Plaintiffs
DALI WIRELESS, INC.